

Continuous Operations

Improving Soldier Performance

JOE W. SIMMONS

Continuous land combat is an advanced warfare concept, made possible by modernization and technology that permit effective movement at night, in poor weather, and in other low-visibility conditions. Historically, armies have been forced to pause in battle because of darkness or the need to resupply and regroup; today, combat operations can be fast-paced, around-the-clock, and intense.

Now that armies have the potential to fight without let-up, continuous operations and night operations will become more common. As a result, units may suffer from decreases in their soldiers' performance in cognitive skills, beginning as early as 18 hours into a continuous operation.

Field Manual 22-9, *Soldier Performance in Continuous Operations*, defines continuous operations as "continuous land combat with some opportunity for sleep, although this sleep may be brief or fragmented." During any continuous operation, there may be periods of sustained combat in which there is *no* opportunity for sleep. A successful application of continuous operations to maneuver warfare therefore requires the development and application of a sleep management plan.

In April 1993, the Dismounted Battlespace Battle Lab, at Fort Benning, was directed to expand its "Own the Night" initiative to include the investigation of ways to improve soldier performance during continuous operations. The Battle Lab has enlisted the help of the U.S. Army Research Institute of Environ-

mental Medicine and the Walter Reed Army Institute of Research to investigate near-term solutions. This effort will include studies on melatonin, caffeine, and a wrist-worn vigilance monitor.

Melatonin Study. Melatonin—a naturally occurring substance released by the human pineal gland—appears to help induce and maintain sleep. The administration of melatonin before periods of sleep may prove to be an effective way to ensure that soldiers get as



much restorative sleep as possible while conducting continuous operations.

The private sector has conducted only limited research on melatonin because of difficulties associated with obtaining patent protection for natural substances. Recently, however, there has been great interest in the use of melatonin. Standard prescription drugs of this type have side effects that limit their use in the civilian sector. In military operations, these adverse effects—notably, next-day impairment in mental performance, learning, and memory—can lead to problems. In spite of these

limitations, such drugs have been used in past military operations, because no other effective sleep aids were available.

In addition to its sleep enhancing properties, melatonin speeds adaptation to sudden changes in work-rest cycles, called "shift-lag," which significantly impair mental performance and work capacity. The regular administration of melatonin just before the desired bedtime improves the ability to adapt to a new schedule.

Shift-lag can be a significant problem for infantry units and others that are suddenly required to adjust from daytime to nighttime operations. In a recent effort, the U.S. Army Aeromedical Research Laboratory and a Special Operations aviation unit conducted a study to determine whether melatonin speeds adjustment to a new work schedule. In this study, mental performance, specifically vigilance, was significantly impaired in crew members given a placebo while melatonin treatment prevented this impairment in other aircrew and ground crew members. Melatonin also significantly increased sleep.

Several studies will be conducted to determine whether treatment with melatonin prevents impaired performance in various operational scenarios, such as following a shift from daytime to nighttime duty. These studies will begin with the administration of melatonin several days before the change in schedule and continue daily during the adaptation period. On each day of the study, aspects of mental performance that are relevant to military operations will be

assessed, including vigilance, reaction time, and marksmanship. The quality and quantity of sleep will also be assessed.

Caffeine Study. Caffeine has significant beneficial effects on certain aspects of mental performance, especially the ability to maintain vigilance and react appropriately to the environment. Doses equal to single or multiple servings of beverages containing caffeine consistently improve visual and auditory vigilance. In addition, moderate doses of caffeine increase alertness and reduce fatigue, as reported by individuals in the tests. Caffeine also prevents many of the adverse effects of sleep deprivation on mental performance. Additionally, caffeine has been shown to sustain and improve mental performance for long periods in simulations of military activities such as sentry duty, marksmanship, and vehicle operation.

Although the effects of caffeine on behavior have been characterized in a number of laboratory studies, no assessment has been made of its effects on soldiers engaged in actual military operations. Furthermore, the most favorable dosage and timing of caffeine administration during sustained operations have not been determined. During Operation DESERT STORM, many soldiers who were engaged in critical duties—such as air defense—consumed massive doses of caffeine in an effort to sustain vigilance and alertness. The effectiveness of such self-medication has not been established, however, and its possible adverse effects on sleep have not been considered. Appropriate recommendations must be formulated for the use of caffeine in sustained operations scenarios.

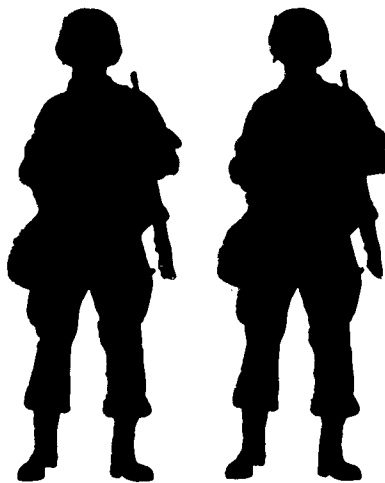
The administration of caffeine, in the proper doses and at the proper time, may be an effective treatment to ensure that soldiers maintain maximum levels of vigilance and alertness when engaged in sustained operations, suffering from jet-lag, or adapting to a changing duty schedule.

The Battle Lab effort will assist Walter Reed Army Institute of Research in conducting two studies, each using a continuous operations scenario. The first

study will seek to determine the optimal dose of caffeine for improving vigilance, performance, and alertness. The second study will assess the optimal timing of caffeine administration.

In both studies, military performance and performance on standardized tests of vigilance, reaction time, and attention will be evaluated, and the subjects' mood and sleep will be measured. In addition to determining the most beneficial effects of caffeine on mental performance, it will be essential to determine whether caffeine has adverse effects on sleep or mood.

Wrist-worn Vigilance Monitor. Few countermeasures are available to pre-



vent decreases in performance attributable to fatigue, disrupted sleep-rest cycles, or sustained military operations in harsh environments. Even highly motivated, well-trained soldiers cannot sustain the necessary levels of alertness when they are on duty for extended periods. For example, the air defense personnel operating missile batteries during Operation DESERT STORM reported great difficulty maintaining the required level of readiness because of fatigue. Exposure to adverse environmental conditions—heat, cold, high altitude—can decrease vigilance, especially at night and during sustained operations.

The Army Research Institute of Environmental Medicine has developed a prototype monitoring device that can assess a soldier's vigilance and, when necessary, provide appropriate stimulation to prevent decreases in attention.

The small, self-contained device resembles commercially available wrist-worn activity monitors. It warns the individual or others of a lapse in alertness and thereby restores vigilance.

Currently, no such devices are available that can continuously monitor and record a soldier's vigilance and alertness while he freely moves around in his environment and participates in normal daily activities. Such a device would provide reliable information on the patterns of soldier performance in operational settings. Ideally, it would also record information on the actual environmental conditions of temperature, ambient illumination, and sound levels.

The Dismounted Battlespace Battle Lab has requested support to develop the monitor for field conditions and to conduct a field study to determine whether it can prevent decrements in performance during sustained and continuous operations, including transitions from day to night operations. In addition to preventing any degradation in vigilance, the device would synchronize the wake and rest cycles of soldiers to the changes in the duty day by permitting sleep only at specific times and ensuring alertness at other times. It could therefore help in the treatment of jet-lag, shift work, and related problems in soldiers engaged in intense training or operational activities.

The fact that soldiers get tired is nothing new, nor is the knowledge that stimulants keep them awake. What is new, however, is the level of research currently under way to determine the most effective—and safest—way to enable our soldiers to operate effectively for extended periods of time under all conditions. The information gained from this Battle Lab initiative will enable our Army to gain and maintain the decisive edge on the multidimensional battlefield of tomorrow.

Joe W. Simmons is Deputy Chief, Battle Command Division, Dismounted Battlespace Battle Lab at Fort Benning.
